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In the same manner we can find other values of m, p, and q, and the number of possible sets does not appear to be limited.

The first part of the proposition, namely, $(2^n-2)/n$ is an integer when n is prime, is but a particular case of Fermat's Theorem that $a^{p-1}\equiv 1(\mathrm{mod}\, p)$ when p is prime and a is prime to p.

Bala, Pa., Feb. 1, 1902.

GEOMETRIC DERIVATION OF CERTAIN TRIGONOMETRIC FORMULAE.

By PROFESSOR L. E. DICKSON.

Students of trigonometry find it interesting to have, in addition to the usual proof, the following geometric derivation of the formulae used in the solution of a plane triangle of given sides. The only trigonometry used is the *definition* of the tangent ratio.

The first step is the usual geometric proof (by means of the theorem giving, in terms of the sides, the projection of one side on another side) of Heron's formula:

$$\triangle = \sqrt{[s(s-a)(s-b)(s-c)]}.$$

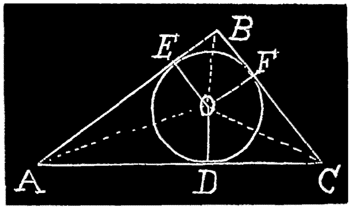
The next step is the evaluation of the radius r of the circle inscribed in the triangle. It its center is O, the areas of the triangles AOB, BOC, COA are $\frac{1}{2}cr$, $\frac{1}{2}ar$, $\frac{1}{2}br$, respectively. Hence

$$\triangle = \tfrac{1}{2}(a+b+c)r = sr.$$

$$\therefore r = \sqrt{\frac{(s-a)(s-b)(s-c)}{s}}.$$

The next step is the simple proof that the length of the tangent from A to the inscribed circle is $AE = AD = s-a$; from B, $BE = BF = s-b$, and from C, $CF = CD = s-c$. Then

$$\tan\tfrac{1}{2}A = \frac{r}{s-a},\quad \tan\tfrac{1}{2}B = \frac{r}{s-b},\quad \tan\tfrac{1}{2}C = \frac{r}{s-c}.$$



These are the most convenient formulae for the solution of a triangle of given sides. We may, however, derive at once the formulae for $\tan\frac{1}{2}A$, $\sin\frac{1}{2}A$, $\cos\frac{1}{2}A$ in terms of a, b, c only. Evidently,

$$\tan\tfrac{1}{2}A=\sqrt{\frac{(s-b)\ (s-c)}{s(s-a)}}.$$

We may obtain $\cos\frac{1}{2}A$ by employing the formula

$$\sec^2\tfrac{1}{2}A=1+\tan^2\tfrac{1}{2}A=1+\frac{(s-b)\ (s-c)}{s(s-a)}=\frac{2s^2-s(a+b+c)+bc}{s(s-a)}=\frac{bc}{s(s-a)};$$

or from the figure, since $AO^2=r^2+(s-a)^2$ reduces to $bc(s-a)/s$. Then

$$\cos\tfrac{1}{2}A=\sqrt{\frac{s(s-a)}{bc}},\ \sin\tfrac{1}{2}A=\tan\tfrac{1}{2}A\cos\tfrac{1}{2}A=\sqrt{\frac{(s-b)\ (s-c)}{bc}}.$$

Similarly, a proof of the sine proportion follows from the relation $a/\sin A=D=$constant=diameter of circumscribed circle.

University of Chicago, Jan. 1902.

SOME FALLACIES IN WENTWORTH'S GEOMETRY.

By DR. GEORGE BRUCE HALSTED.

Often both to teacher and pupil instruction seems satisfactory which to the expert is deliciously absurd.

The American-University-girl's French in Paris is a field of rich humor. Fashionable restaurants have hired waiters for their ability to understand this strange language, American French.

I went once with a party of Americans to buy gloves at a famous place on the Avenue de la Opera. "How does it happen that you understand our French so well?" was asked the attendant.

"Why, that's not strange," she answered, "I am an English-woman!"

Again, a young lady from Texas, a student of French, bought a parasol at the Bon Marché, that store which has the genius to say "We will exchange what you buy, whenever it ceases to please you." The very next day she took it back, but what she really did say in French to the attendant was "I bought this here *tomorrow*." The polite attendant never smiled, but, though he spoke English fluently, answered slowly in French: "If mademoiselle bought it here tomorrow, we are glad to receive it back or exchange it."

The French words for horses (chevaux) and for hair (cheveux) differ only in the one vowel, and Americans are vowel deaf.

This explains the apparently mysterious statement of the young *coiffeur* who said, "I begin to learn that American French. When an American lady drives up and asks me to wash her horses, that means she wishes her hair dressed."